FAO FISHERIES BULLETIN

Volume X, Number 2 April-June 1957

CONTENTS

GOVERNMENTAL SERVICES TO THE SEA FISH INDUSTRY OF GREAT BRITAIN 65

A GEAR RESEARCH VESSEL 85

BULK FREEZING OF FISH 89

FISHERIES DIVISION ACTIVITIES 98

NEW PUBLICATIONS 111

Editor: D. B. Finn

The *FAO Fisheries Bulletin* is prepared by the staff of the Fisheries Division and is published in English, French and Spanish. The contents have not been copyrighted and may be reprinted freely, but reference to source will be appreciated. Annual subscription: U.S. $1.00; single copy: 30 cents; rates are payable in local currencies when orders are placed through local sales agents. See inside back cover for list of sales agents.

Opinions expressed in signed articles by non-FAO staff members are not necessarily those of the Organization.

Reprints of feature articles are available from FAO Headquarters, Rome, Italy.

Printed in Italy

Loading herrings (train) for Czechoslovakia ; this forms part of the export trade of Great Britain (see monograph *Governmental Services to the Sea Fish Industry of Great Britain*)

(Photo ; Fisheries Laboratory, Lowestoft, England)

GOVERNMENTAL SERVICES TO THE SEA FISH INDUSTRY OF GREAT BRITAIN

(This article is a summary of the monograph of the same title, prepared for FAO under the auspices of the Royal Institute of Public Administration, London, by F. M. G. Willson, Gwilym Gibbon Research Fellow, Nuffield College, Oxford, England).

I. Structure of the Industry

At the present time, the British fish trades handle each year some 1,100,000 tons of fish other than shellfish. Roughly 50,000 tons are imported canned fish, imported fresh or frozen migratory fish, and the relatively very small amount of fresh-water and migratory fish caught in Britain. Another 50,000 tons are fresh or frozen sea fish imported in boxes. The remaining million tons are fresh sea fish, about 95% being landed by British fishing vessels. This million tons brought £47½ million on first sale in 1955. In addition, British boats landed £1½ million worth of shellfish, and £900,000 worth of shellfish were imported in the same year. Of all the fish mentioned, only some 50,000 tons are exported annually; the rest goes to satisfy the demands of a home population not far short of 50 million. There are some 25,000 to 30,000 fishermen in Britain, and at least four times that number of people are employed in the distribution of fish and in ancillary trades.

The British sea fish industry is very complicated, particularly on the production and marketing sides, and it is only possible here to describe its main features. A distinction must be made at the outset between the different positions of the industry in the two major component parts of Great Britain — England and Wales on the one hand, and Scotland on the other. Scotland has 35% of the land area and only 10% of the population, but 40% of all the fishermen in Britain live there, and no less than one third of the landings of sea fish, by weight and by value, is made at Scottish ports. The sea fish industry is thus relatively much more important in Scotland than it is in England and Wales, and as will be seen, there are considerable differences in commercial organization and in the relevant governmental administration of the two areas.

White Fish

The production or catching side of the industry falls into three sections. The first is the catching of white fish in sea areas beyond the inshore or coastal waters, mainly by trawling, and to a much lesser extent by seining and lining. White fish caught in such areas and by such methods comprise more than two thirds of the total weight and about three quarters of the total value of all

fish landed by British vessels. Four fifths are landed in England and Wales, and one fifth in Scotland.

The catchers of white fish are clearly divided into two groups. More than half the total catch is taken in what are known as the " distant waters " — the grounds in the Barents Sea, and those adjacent to Bear Island, Greenland, Iceland, the Norwegian coast and Newfoundland — by a fleet of very large trawlers based at the three English ports of Hull, Grimsby and Fleetwood. There were 265 of these distant water vessels at the end of 1955. The rest of the white fish taken outside the inshore areas comes from grounds nearer home — from those around the Faroe Islands, known as the " middle waters, " and from the " near waters " — the North and Irish Seas and other sea areas adjacent to the coasts of the British Isles. The middle and near waters are exploited by over 600 trawlers varying from 70 to 140 ft. in length, and based mainly on seven ports — Grimsby, Fleetwood, Lowestoft and North Shields in England, Milford Haven in Wales, and Aberdeen and Leith in Scotland. There is a fleet of some 60 seine net boats at Grimsby which must be included in this second section of the white fish catchers.

The trawlers are usually owned by shore companies, and very few skippers or crew members have any share in that ownership. There are more than 150 registered owners in England and Wales, but because of interlocking arrangements, the use of subsidiary companies and the frequent divorce of ownership from management, it is impossible to estimate the number of controlling concerns. At Aberdeen and Leith, ownership is relatively more widely diffused. The whole trawling industry for white fish, including the few great line vessels and the Grimsby seine net boats, employs about 14,000 men.

Herring

The second section of the industry is concerned wholly with one species — the herring — a highly perishable, seasonal, pelagic fish. The bulk of the herring taken by British fishermen is caught with drift nets, and a small proportion of the catch is taken with ring nets. The herring grounds are never more than 70 or 80 miles from the coast, and because of the seasonal nature of the fishing, the fleets move from district to district. The main fishing is off north, northwest and east Scotland in the summer, and off the southern half of eastern England in the autumn. Two thirds of the herrings are landed in Scotland at a number of relatively small ports, which are often largely dependent on the herring fishing and are equipped with the full range of processing plants essential to the herring industry. The English herring trade is mostly concentrated on the two sizeable ports of Yarmouth and Lowestoft.

Catches of herring fluctuate enormously, both in size and quality. In the five years 1951-55 the average annual weight of British-taken herring landed in Great Britain was nearly 190,000

tons. In 1955, the catch weighed 160,000 tons and was sold on first-sale for a little over £3 million — about 17% of the total weight and about 6½% of the total value of all British-taken sea fish excluding shellfish.

The herring fleet is in a state of rapid transition. The idea of having boats solely to catch herring has been to a great extent abandoned, and at the end of 1955 there were only about 70 of the old steam herring drifters left in service. In England and Wales their place has been taken by Diesel-powered steel drifter/trawlers, and in Scotland by wooden motor vessels. These new boats divide their attention between herring and white fish according to season. The size of the total herring fleet is therefore difficult to ascertain, but at the end of 1955 there were less than 100 steam drifters and drifter/trawlers in England and Wales, and some 300 motor drifters, mostly based in Scotland. In addition, there was a Scottish fleet of more than 120 motorboats using ring nets. The English vessels are mostly company-owned, but in Scotland the fishermen themselves own most of the herring boats. Between 4,000 and 5,000 fishermen are employed in the herring industry.

Inshore Fisheries

The third section of the catching side of the sea fish industry is the inshore section, and it is more easily recognized than defined. It comprises those fishermen who work mainly in coastal or relatively near coastal waters, whose voyages rarely last more than 72 hours and more usually last less than 24 hours. The inshore men adopt most of the methods of fishing used by their " deep sea " brothers. The majority of their boats are less than 40 ft. long, but in Scotland there is a very important inshore fleet of larger seine net vessels. The harvest of the inshore fisheries is white fish and shellfish. The inshore boats have almost a monopoly of shellfish, but in England and Wales only about 3% of the total weight of white fish landed comes to the numerous small inshore stations, which are quite separate and entirely different in character from the big " deep sea " fishing ports. In Scotland, however, the extensive inshore fisheries account for over one third of the total weight of white fish landings. At the end of 1955, there were more than 5,000 boats under 40 ft. in length. All but a few are owned by the working fishermen ; company ownership is very rare. There are probably about 10,000 inshore fishermen in Great Britain, but because of some overlapping with herring and white fishing, and because many inshore fishermen only spend part of the year fishing, the total is uncertain.

Marketing, Processing and Distribution

The primary and principal institution in the distribution of fish to the consumer is the quayside market. In the main white fish ports practically all the fish landed are immediately auctioned. Herring must be offered for sale by auction, but in the herring trade

there are extensive price fixing practices (to be described later), which ensure that only a proportion of the herring is subject to bidding. The auction system is less common in the inshore fisheries because of the small scale of operations, and instead there are a variety of distributive channels.

Most of the buyers at the auctions are wholesale merchants or processors — there are about 2,000 firms. A high proportion of the fish landed is processed in one way or another. Much of the white fish is filleted at the ports. A growing proportion — though still less than 10% of the white fish catch — is quick frozen and a roughly similar quantity is salted, smoked or canned. A far greater proportion of the herring landed undergoes some process which changes the character of the fish. Less than 20% of the total herring catch is sold fresh to consumers. About 40% is processed for human consumption and an equal percentage goes for conversion to meal and oil. These proportions vary a good deal, however, from year to year.

The fresh and processed fish go from the coastal merchants either to big inland markets, where it is often handled by inland wholesalers, who operate from about 1,000 premises, or direct to retailers. Rail transport still predominates, but there is a notable usage of insulated road vehicles. The retail outlets are of two main types: the fishmonger, who usually sells fish along with either poultry or with greengrocery and fruit, and the fish fryer, whose establishment is really a small café specializing in fried fish and fried potatoes. This is a typically British institution called a " fish and chip " shop, which takes at least 30% of the total white fish catch. At the end of 1955 there were at least 16,800 retail fishermongers' premises, and at least 14,800 fish and chip shops in Great Britain.

II. Government Organization

The functions performed by the Government in connection with the sea fish industry fall into two groups those entirely concerned with fisheries and which are, therefore, unrelated to any other aspect of governmental work and those which apply in some measure to the fishing industry but have also to be performed in other contexts and for other interests. The functions of the first group are divided between two orthodox central government departments, two special statutory bodies, and a group of local Sea Fisheries Committees. The second group of functions are performed by various orthodox central departments, elected local authorities, and various special administrative bodies.

The Fisheries Departments

The two orthodox central departments wholly concerned with fisheries are the Fisheries Department of the Ministry of Agriculture, Fisheries and Food, whose jurisdiction is mainly confined to England and Wales, and the Scottish Fisheries Department, which is

part of the Scottish Home Department. The Ministers concerned — the Minister of Agriculture, Fisheries and Food and the Secretary of State for Scotland — who are responsible to Parliament for every action taken by the Fisheries Departments, are not, therefore, solely concerned with fishery matters, and indeed there is little likelihood, both in view of the existence of a separate Scottish department and of the relatively small size of the sea fish industry in a highly industrialized nation, that there will ever be one Minister wholly occupied with fishery business.

The two Fisheries Departments are similarly organized. Headquarters are in London and Edinburgh respectively, and there are numerous outposts. The coast of England and Wales is divided into ten districts and the Scottish coastline into 22 districts. An inspector in England and Wales and a fishery officer in Scotland is in charge of each district. These locally based officials are not only concerned with executing fishery law and policy, they also provide liaison between the Government and the industry, interpreting departmental policy and offering advice to fishing interests. They report to chief inspectors and work in conjunction with the special administrative branches at headquarters which deal with particular aspects of fisheries. There are full-time collectors of statistics at all the major English and Welsh ports and at Aberdeen and Leith, and a large number of part-time, fee-paid collectors who work in the inshore districts. Both the Fisheries Departments maintain scientific laboratories and research vessels ; the Scottish Department has a fleet of small cruisers for patrolling and protecting the coastal fishing grounds, and two dredgers for use in fishery harbors.

The Herring Industry Board and the White Fish Authority

The two special statutory bodies are the Herring Industry Board and the White Fish Authority. They are concerned with regulating, re-organizing and developing their respective industries, and their writ runs throughout Great Britain. They are appointed jointly by the Minister of Agriculture, Fisheries and Food, the Secretary of State for Scotland and the Home Secretary, the latter being the Minister responsible for Northern Ireland affairs. The Herring Industry Board has a chairman and two other members, all part-time, and headquarters in Edinburgh. The White Fish Authority has a full-time chairman and four other part-time members. The Authority's headquarters are in London, but there is also a Committee for Scotland and Northern Ireland with headquarters in Edinburgh. * The Board employs a number of local officers who move from port to port according to season, a few scientists, and an industrial staff

* Northern Ireland, the fourth national unit making up the United Kingdom of Great Britain and Northern Ireland, is not dealt with in this article. There is a small inshore fishing industry, and the counterpart of the Fisheries Departments in England and Wales and in Scotland is the Northern Ireland Ministry of commerce, responsible to the local Parliament at Belfast. The Herring Industry Board, as well as the White Fish Authority, deal with fishermen in Northern Ireland.

in their factories. The Authority has area officers and freezing inspectors at some of the ports.

The Ministers primarily responsible for fisheries may give these two special statutory bodies general directives as to the exercise of their functions if the Ministers feel such directives to be requisite in the national interest, but the bodies are otherwise free to act on their own initiative, and, indeed, must carry out their statutory duties. The Board and the Authority have several sources of revenue. They impose levies on the first completed sales of fish and they charge small fees for licensing and registering traders. The bulk of their income, however, is provided by the central Government in the form either of grants or loans which must be used for particular approved purposes, and which must not exceed in aggregate over a defined period certain limits laid down by statute. The Board and the Authority each has an Advisory Council whose members are nominated by Ministers to represent the various sections of their industry.

Sea Fisheries Committees

In Scotland, there are no local governmental bodies exclusively concerned with fisheries administration, but in England and Wales there are 11 Sea Fisheries Committees whose areas, taken together, cover a large part of the coast-line. Each committee has jurisdiction over a stretch of coast and over the adjoining coastal waters as far as the boundary of British exclusive fishery limits. A Sea Fisheries Committee is a joint body made up of representatives of the elected councils of counties and boroughs, and of the local river boards, whose areas fall wholly or partly within the committee's district, together with members nominated by the Minister of Agriculture, Fisheries and Food. Each committee employs a full-or part-time clerk, and one or more full- or part-time fishery officer who are in some cases also fee-paid collectors of statistics for the Fisheries Department. The committees are wholly financed by their constituent local councils.

Other Governmental Authorities

Functions which relate to the sea fish industry, although not exclusively concerned with it, are more widely spread than are those functions which are concentrated in the authorities already mentioned. Of the central departments other than the Fisheries Departments, the Ministry of Transport and Civil Aviation, which is charged with most of the Goverment's functions in relation to shipping, has the most to do with fisheries, and it has jurisdiction, in the relevant context, over the whole of Great Britain. Among the other central departments providing some service or services used by the fishing industry are the Admiralty, the Air Ministry, the Ministry of Labour and National Service, and the Department of Scientific and Industrial Research. There are a host of special

public administrative bodies other than the Herring Industry Board and the White Fish Authority. The fishing industry draws on the services of, or comes into contact with, as an ordinary customer such authorities as Trinity House, which provides navigational facilities, and the British Transport Commission, which runs the railway system and owns certain docks and harbors. At local level, people engaged in the fish trades come into contact with their locally elected general purpose council mainly in the latter's capacity as market, public health, and in some cases harbor authority. In England and Wales, the powers of a Sea Fisheries Committee has been given to 11 river boards. A river board is rather similar in constitution to a Sea Fisheries Committee, but is mainly concerned with land drainage, the prevention of river pollution, and the regulation of salmon and fresh-water fishing. Only three of these river boards use the Sea Fisheries powers to any extent, however. These powers have also been granted to two harbor authorities. Harbor authorities —which are very important to the sea fish industry in their normal capacity — may be autonomous corporations or trust, municipal corporations, limited companies, individual proprietors, or the British Transport Commission, which owns some 30% of the total port capacity of the country.

III. Background to the Present Services

The various governmental authorities just described provide a very wide range of services to the sea fish industry, and most of those services concern the catchers. Modern fisheries administration in Britain began in the 19th Century, when the main governmental functions concerned the regulation of fishing within territorial waters, the safety of vessels, and the enforcement of certain international conventions. Towards the end of the century the official collection of fisheries statistics began, and the forerunners of the present Fisheries Departments also started to conduct and help to finance fisheries research. These functions have since been considerably extended, but they continue to be the basic work of the Fisheries Departments and were, until the 1930's, the only sort of activity performed by the Government in the interest of the sea fish industry. In the 1930's, however, the Government began to take a different kind of interest — in fact, to intervene in the affairs of the industry in order to influence its general economic condition. This new form of governmental activity became much more important after the second World War, and has involved the extension of considerable financial assistance to most sections of the catching side of the industry. The main institutional manifestations of this new type of governmental concern for the industry have been the Herring Industry Board and the White Fish Authority, which were set up in 1935 and 1951, respectively.

The growth of governmental intervention in economic affairs is one of the main features of the recent domestic history of Britain,

and the new interest taken in the sea fish industry since the 1930's can be seen as merely one episode in a general movement of political and economic ideas and governmental practices. But the measures taken in the interest of the fishermen were also, in fact, responses to particular economic situations. The range and character of the present measures of financial assistance and economic supervision can perhaps best be appreciated if some very brief account is given of the outstanding features of the history of each of the three sections of the catching side of the industry during the last half century.

Just before the first World War, both the herring and white fish trades were prosperous and expanding. About the same weight of herring and white fish were landed annually; the herring industry relied to a great extent on the East European markets for cured herring, while the white fish catchers were mainly concerned with meeting increasing demands at home. The long term effects of the first World War on the herring industry were catastrophic. The East European market was greatly reduced after 1918; between 1913 and 1933 the export of cured herring fell by 55%, and it has since dwindled still further. Moreover, the home demand dropped by 45% in the same period, as public taste changed and as alternative cheap foods became available. But the number of vessels and fishermen did not fall as rapidly as the demand for herring and, by 1930, there was a chronic redundancy of boats and crews. For years almost no new herring boats were built, and the general position had only slightly improved when the second World War broke out.

The herring catchers, however, have always suffered from the seasonal character of herring fishing and the highly perishable nature of the fish. When herrings appeared in overwhelming profusion, the waste in times past was enormous, as there was no possibility of storing such quantities for processing and distribution at a later stage. Gluts, therefore, meant ruinous prices for the catchers and often fish had to be dumped back into the sea. The modern process of converting surplus herrings into meal and oil was not developed on a commercial scale before 1939.

While herring declined in popularity, white fish were increasingly demanded. In meeting that demand, the trawlermen of both Britain and other countries of Western Europe over-exploited the near and middle water grounds during the inter-war years. As the fish were no longer available in sufficient quantities near home, larger trawlers were built to venture farther afield, and in due course began to flood the markets with greater quantities of the cheaper varieties of fish from distant waters. Much of the near and middle-water fleet thus became redundant and, as in the herring industry, few new vessels of the type were built. Nor was the distant water section without its troubles, but in this case it was overproduction rather than underproduction which caused anxiety.

As a result of the development of steam-powered fishing craft and the necessary concentration of such craft at sizeable ports where

big markets grew up, the inshore fishermen, at any rate in England and Wales, steadily lost ground, and those who remained were only able to continue because of the high quality of their small catches and because of their monopoly of the shell fisheries. The Scottish inshore industry, perhaps because of the larger scale of its operations, managed to retain far more of its old predominant position.

The economic conditions of the second World War and its aftermath were in most ways more favorable to the industry than those of the preceding two decades, but the legacy of the past remained, and some new problems have been added by contemporary events. Since 1945, only the distant water trawling section has been considered by the Government to be in a sufficiently sound economic condition to stand on its own feet. The problem of overproduction from the distant waters is met by the trawler owners themselves, who operate a private scheme controlling the size of catches, the number of crew carried on each vessel, the number of vessels used, and the periods of "laying up." All the other sections have been faced with a shortage of private capital for the re-equipment of fleets, many of the vessels being of considerable antiquity by 1945. Moreover, catchers have had to meet steadily rising overhead costs, the continued ill-effects of overfishing for white fish in the near and middle waters and the further loss of export markets for herring. However, the slight drop in home demand for fish as food supplies improved after the stringencies of wartime.

It will be seen in the following pages the kind of action the Government now takes to meet those problems also how it proposes to keep the cost of food down as far as possible. The long-term responsibility which the Government has accepted is the comprehensive one of helping the catching side of the industry to become stable and self-supporting by the offer of financial assistance, by encouraging the consumption of fish and the by-products of fish, and by promoting all necessary reorganization and regulation of every branch of the trades concerned. This means that the Government is now more concerned with the distributive trades than ever before save in wartime, but even so, the relevant administrative activity is very small when compared with that concerning the catchers.

The broad distinction between the mainly regulatory or traditional functions of the Government, e. g., the sea fish industry, and the newer economic functions, is not exactly the same distinction as that between the work of the orthodox Fisheries Departments on the one hand, and the two special statutory bodies on the other. Both sets of authorities are deeply concerned with policy and with the economic supervision of the industry, and the Ministers responsible for fisheries and their Departments administer much of the financial assistance. But the Departments have almost a monopoly of the traditional regulatory functions, they are overwhelmingly concerned with the catching side, and their general attitude is inevitably different from that of the Herring Industry Board and the

White Fish Authority. The Departments must make the public interest the yardstick by which to measure the actions of the industry, and while they are properly keen to help the catchers, they also have to see that the industry plays the game by the rules. The Herring Industry Board and the White Fish Authority, by contrast, are more closely associated with the commercial interests of the industry itself, and while they must keep in mind the interest of the consumer, they cannot, if they are to win the confidence of the industry, act in quite so detached a manner as the Departments. Their net is also more widely cast than that of the Departments in that they — and particularly the White Fish Authority — are much more concerned with the distributive trades.

IV. Governmental Services

The services which the Government provides are here described at each stage of the progress of the fish from the sea to its ultimate consumers. The description of the organization of statistical work and scientific research is given separately in the closing section of the article.

Care and Regulation of Shell Fisheries

In British territorial waters the bed of the sea, much of the foreshore, and the bed of tidal waters belong to the Crown. Many of the important shell fisheries on or above them were, in the past, granted or leased to private persons, and the present owners or lessees include individuals, companies and, in a few cases, local councils. There is a special statutory procedure for establishing a private shell fishery, and an order made under that procedure may include provisions concerning the improvement, maintenance and regulation of the fishery. Public shell fisheries in England and Wales can be regulated by Sea Fisheries Committees, and in Scotland by the Fisheries Department; both authorities may finance the stocking or re-stocking of a public fishery.

The major motives for governmental control of shell fisheries are to protect those fisheries from physical damage and to protect the public from polluted shellfish. Detailed regulations deal with such matters as preventing dredging for ballast; the destruction of predatory fish, animals or birds; and the definition of close seasons and of the size and condition of shellfish which should not be taken or sold. Constructional works for protection of the coast, sewage disposal, and the establishment of gunnery practice ranges, may involve injury to fisheries or interruption to fishing, and it is the concern of the fisheries authorities to see that fisheries interests are represented when decisions about construction, etc., are taken. The Ministry of Agriculture, Fisheries and Food runs one cleansing unit for mussels, and a few local councils offer similar facilities.

Restrictions on Fishing for Wet Fish

Foreign vessels may not fish within British territorial waters, which the Government claims to be generally of three miles breadth.

International rules made to conserve stocks are enforced by the British Government. The rules concern the maximum size of the meshes of nets to be used in particular areas, and the minimum size of fish which may be landed or sold. In addition to these international restrictions, there are certain domestic regulations which apply within territorial waters and prohibit the use of methods and gear which may be harmful to seafish.

In the economic interests of inshore fishermen, trawling and seine net fishing are forbidden or restricted within territorial waters. Other inshore restrictions are imposed to prevent accidents through the fouling of different sorts of gear, or for conservation purposes.

The Herring Industry Board is concerned with ensuring that the herrings sold are of a high quality, and, with preventing poor quality fish from reaching the market. The Board prohibits the sale of herrings caught more than a certain time before landing, and prohibits their curing between certain dates and of those which do not satisfy certain specifications. The Board also sometimes has to restrict fishing during the occurrence of gluts to prevent landings in excess of what can be handled by the oil and meal reduction plants.

Enforcement of Regulations

In Britain, the police do not normally concern themselves with the enforcement of fisheries regulations unless asked to do so by the fisheries authorities. The local officers of the Fisheries Departments and, in England and Wales, the officers of Sea Fisheries Committees, river boards and harbor authorities, together with the officers of local public health and market authorities and of the Herring Industry Board, are principally responsible for law enforcement ashore. They carry out such duties as inspecting the meshes of nets, taking action regarding the landing of undersized fish, and deciding immediately after fish are landed whether they are fit for human consumption.

For law enforcement at sea there is a threefold organization. Off the Scottish coast, mainly within the territorial waters and exclusive fishery limits, the cruisers of the Scottish Fisheries Department operate and are augmented by a naval vessel. Off England and Wales, within the exclusive fishery limits, a few Sea Fisheries Committees have patrol vessels, but the bulk of the work of fishery protection is carried on by a naval squadron which also operates beyond the exclusive fishery limits. There is close liaison between the naval and fisheries authorities. National regulations can be enforced on all British fishing vessels wherever they may be, and on foreign vessels within British exclusive fishery limits, by any British Sea Fishery Officer — a title given to a large number

of government officials and commissioned officers of naval ships. Commanders of naval Fishery Protection Vessels can exercise jurisdiction over foreign vessels in certain areas beyond exclusive fishery limits which are defined in various international conventions. Within territorial waters off England and Wales the by-laws of local Sea Fisheries Committees can only be enforced by officials of those committees.

Maintenance of Fishery Harbors

The central Government does not intervene in the routine work of harbor authorities, but the establishment and operation of harbors are governed by certain procedures which need the approval of a government department. The general ports, including those with fish docks, such as Hull, Grimsby and Aberdeen, are self-supporting financially and therefore have no need of special help towards meeting the cost of maintenance. Such ports are the concern, in government circles, of the Ministry of Transport and Civil Aviation.

The maintenance of the small harbors principally used by herring and inshore fishermen, calls for considerable financial assistance from the State. Most small harbor authorities were impoverished as a result of the decline of herring inshore fisheries, and funds for repairs and improvements now come mainly from the Fisheries Departments, though the harbor authorities may borrow from banks and over private lenders, or from the Public Works Loan Board. Sea Fisheries Committees are empowered to help harbor authorities but such help as is forthcoming from that source is extremely limited.

The Fisheries Departments make grants or loans, or both, to harbor authorities which do not trade for profit, for the construction, improvement or repair of harbors, so long as such expenditure will promote the maintenance or development of the fishing industry. The harbor authorities themselves take the initiative in applying for help, and the Fisheries Departments then make their own enquiries, sometimes with the help of the Herring Industry Board and the White Fish Authority, also take advice on engineering problems involved from other government departments. The two dredgers owned by the Scottish Fisheries Department are available to all fishery harbor authorities in Scotland, and the service may be performed free or at a reduced charge.

Dock Labour Scheme

At three of the major fishing ports which are also general ports the fish dock workers come within the Dock Labour Scheme, which is organized by a National Dock Labour Board and by local Dock Labour Boards. The Scheme ensures a greater regularity of work for dockers than was enjoyed by them in earlier times. The

local Dock Labour Board, acting as agent of the employers, registers, pays and allocates the workers to particular ships. If there is not enough work to enable a docker to earn a particular sum each week, he receives a payment in lieu of wages from the Dock Labour Board which, in turn, is financed by a levy on the port employers.

Regulation of Fishing Vessels

The complex code of law relating to the regulation of fishing vessels is based on a comprehensive system of registration of those vessels. Registration involves the measurement and survey of a vessel and the recording of various details about its construction, ownership, etc. Each vessel is given an official number, which must be clearly marked on specified places, together with certain other information. The mode of fishing and number of crew normally employed are also recorded, and all details of registration are regularly checked and kept up-to-date. The Fishing Boat Register divides vessels into three classes according to tonnage, length and motive power. Registration is usually carried out by Customs officers, though fishery officers do the work in some Scottish ports. There is a central register kept by the Register General of Shipping and Seamen, whose department is a branch of the Ministry of Transport and Civil Aviation. All the larger mechanically-propelled boats used for herring fishing are licensed by the Herring Industry Board.

Vessels may be inspected at any time by marine surveyors of the Ministry of Transport and Civil Aviation to ensure their seaworthiness, and many owners voluntarily submit their vessels to regular inspection. There are extensive regulations governing the manning of fishing vessels and defining in detail what lifesaving gear, fire appliances, lights and sound signals, and medical stores have to be carried, and under what conditions boat and fire drills must be carried out. Minimum standards of crew accommodation and the cleanliness of that accommodation are also enforced by inspection.

Financial Assistance for Re-equipping the Fleets

In the ten years following the end of the second World War, more than £3 million in grants and well over £6 million in loans were made available by the Government to the owners of fishing vessels towards the cost of new boats, new engines, conversion and reconditioning of ships, and new nets and gear. The money has been disbursed under a number of schemes; the present arrangements are administered by the Herring Industry Board and the White Fish Authority.

This financial aid is intended for near and middle water white fishing, herring fishing and inshore fishing, and no grants or loans are available for vessels more than 140 ft. in length. The general terms of the main schemes are that owners may receive grants of 25%, and in some cases of 30%, towards the cost of new vessels,

and that certain owners may receive up to 30% grant towards the cost of new engines. A further 55% or 60% of the cost of new vessels or engines may be loaned to owners. Loans of up to 60% of the cost of nets and gear may also be made. Thus, all owners have to find at least 15% of the total cost of new vessels and engines, and at least 40% of the cost of nets and gear, the remainder being made available by the Government. The Herring Industry Board cannot, however, give a grant of more than £15,000 for any one vessel, and the White Fish Authority's limit is £30,000.

Grants and loans are only given after careful and thorough enquiry into the financial circumstances and character of the applicant, and after the authorities are satisfied that the applicant will be able to operate successfully. Moreover, the conditions under which grants or loans are made are inevitably stringent. High standards of construction, equipment and accommodation are enforced, and during the " control periods " which follow the extension of assistance (the periods are 10 or 20 years in the case of new boats, according to size) the vessels must be insured at an agreed valuation, and records must be kept which the Herring Industry Board or the White Fish Authority may inspect at any reasonable time. The authorities are also specially protected against any loss of vessel or breach of agreement. Loans for nets and gear are repayable over periods of not more than three years.

Qualification and Training of Fishermen

The Ministry of Transport and Civil Aviation insists that fishing boats carry a minimum of qualified personnel consistent with the need to ensure safety of life at sea. Five grades of certificate are awarded to skippers and second-hands; they may be full, limited or special according to size of vessel and area fished. No fisherman can become a certificated second-hand unless he is at least 19 years of age, and he must be 21 years of age before he can become a certificated skipper. Minimum periods of seagoing and seafishing experience are also laid down. The examination for a certificate entails a written examination in navigation, an oral examination in navigation and seamanship, and an examination in signalling, together with a sight test.

The traditional system of apprenticeship in merchant ships is rare in the fishing industry today, though the statutory framework for it still exists. All fishermen learn their trade by practical experience, and formal instruction is usually limited to preparation for the certificate examinations. Such instruction is provided locally in nautical and/or technical schools. These schools receive grants from the government Education Departments towards the cost of running approved courses. Fishermen who attend such courses inevitably lose their earnings temporarily. In compensation, they receive unemployment insurance benefit, and the White Fish

Authority offers maintenance and dependants' allowances to certain fishermen during their periods of study ashore.

Protection of Fishermen

The unique characteristics of seafaring and a past history of bad working conditions are responsible for the close attention now paid to the welfare of seamen and fishermen in Britain. The responsibility for seeing that fishermen are lawfully engaged, properly treated and honestly remunerated, rests with the local Mercantile Marine Superintendents of the Ministry of Transport and Civil Aviation, to whom skippers and fishermen look for impartial decisions and advice on matters covered by the relevant parts of the Merchant Shipping Acts.

The functions of a Mercantile Marine Superintendent are inquisitorial and judicial as well as executive. He is obliged to enquire into the causes and particulars of any death, injury, ill-treatment or punishment of fishermen at sea, and of every casualty to vessels, and he must take steps to bring any alleged offender to justice. (Serious casualties to fishing vessels may be investigated by a special court which has power to suspend or cancel the certificates of skippers or second-hands). The Superintendent must take a special interest in the welfare of young persons and boys on fishing boats. Perhaps his most usual work of adjudication is in connection with problems of the remuneration of fishermen.

The method of remunerating fishermen is extremely complex and tends to vary from port to port. Various calculations have to be made after the catch is first sold, including numerous deductions from the gross proceeds to meet certain allowable expenses, before the net proceeds can be divided and the claims of individual crew members met. In order to avoid confusion and possible fraud, a number of procedures have been developed which involve the superintendent and may call for the settlement of disputes by him. Such disputes sometimes arise out of the interpretation of the Agreement, which has to be drawn up between the owner and every member of the crew of all the larger fishing vessels, either for each voyage or for a period of up to six months. There is a statutory power under which the " signing on " and " signing off " of the crew would have to be witnessed by the Mercantile Marine Superintendent, but this power is not used except in the case of " signing on " at the port of Aberdeen.

Provisions and water carried on vessels must not be deficient in quality or quantity, and minimum standards are enforced by Inspectors of Ships' Provisions.

National Insurance

All fishermen, save those who own their own boats and operate them single-handed, come within the national schemes of social insurance against ill health, unemployment, old age and

industrial injury, as " employed " persons. A special arrangement has been made to treat those inshore and herring fishermen who own shares in boats as " employed " persons and not as " self-employed, " thereby making them eligible for unemployment benefit.

Labor Relations

Industrial disputes are almost unknown except in the large-scale trawling industry. If a dispute does arise in that section and the industry's internal organization for dealing with it fails to bring about a settlement, the Minister of Labour and National Service may in certain circumstances provide services of conciliation and arbitration.

Order and Safety on Fishing Grounds

Like all other seagoing vessels, fishing craft must observe internationally agreed rules of navigation, and they also make use of the navigational, meteorological and lifesaving services provided by national organizations. In addition to the regulations imposed on them within territorial waters, however, fishing craft must also observe various rules on the high seas which relate peculiarly to them. Such rules are mostly concerned with the handling of gear, and they are made either by the British Government alone or by several governments under international conventions applying only to certain sea areas. Enforcement of these regulations is the business of the Admiralty's Fishery Protection cruisers, which also look after the legitimate interests and welfare of British fishing craft. The duties of the cruisers may include, among other things, providing medical aid, especially in distant waters, and diverting ships which might disturb or damage the long fleets of drift nets extending from herring drifters.

The Herring Trade: Price Fixing and the Meal and Oil Scheme

To bring stability into the herring industry and to guarantee an economic return to the catchers, complex arrangements for the sale of herrings are now made by the Government; those arrangements include a measure of price support and regulation, and the development of meal and oil factories which take any surplus herring. This latter development is the basis of the present system. To give the fishermen a worthwhile price for surplus herrings, the Government has subsidized the production of oil and meal and financed the building of a number of reduction plants by the Herring Industry Board. The Board buys all surplus herrings at a price fixed by the Government, and arranges for their processing. Any loss which the Board incurs on the sale of oil and meal is met from public funds — in the three years 1952-54, the loss amounted to more than £1½ million. But because there has not yet been developed any method of preserving herring for long periods before

reduction to oil and meal, it is necessary, as has already been seen, for the Herring Industry Board to restrict fishing when landings are likely to exceed the capacity of the reduction plants. Fishing is normally restricted by dividing the fleet into two or three sections and only permitting those sections to operate on successive nights.

The price fixed by the Government for herrings destined for the oil and meal factories is the bottom price, and the Herring Industry Board would never attempt to outbid merchants who wanted herrings for other purposes. But the oil and meal price cannot be fixed in isolation, and it is, in fact, calculated with reference to what herrings destined for other outlets are likely to bring. The prices for these other outlets are not, however, left to the operation of a free market. A top minimum price is fixed by the Ministers responsible for fisheries for herring sold for "freshing," kippering and certain analogous forms of processing for home consumption. Once this minimum home market price and the oil and meal price are fixed, the Herring Industry Board calls together the representatives of the catchers, processors and merchants to negotiate prices for the other outlets, i. e., canning, quick-freezing, marinating, pickle-curing, klondyking, redding and pet food manufacture. There are, thus, statutory prices at the extremes, and about half a dozen negotiated prices in between which, while not endorsed by the Herring Industry Board, are nonetheless, in practice, binding on all parties.

A quayside auction begins with the auctioneer offering the catch to home market merchants who may bid at or above the statutory minimum. When home market demands have been satisfied, the residue is offered at the agreed, fixed prices to each of the other outlets for human consumption in an agreed order. After that the pet food manufacturers take what they want and the remainder goes to the meal and oil factories.

The White Fish Subsidy

The Government does not fix prices in the white fish trade, but instead gives a straight-forward subsidy to inshore, near and middle water fishermen using vessels of not more than 140 ft. in length. The scheme now in operation (January 1957) divides vessels into three categories. Inshore fishermen using small craft and making short voyages receive 6*d* or 8*d* (according to type of fish) on each stone (6.36 kg.) of fish landed and sold first hand (not including retail sale) for human consumption. Near and middle water vessels and seine net vessels making voyages of more than seven days' duration receive a flat rate payment for each day spent at sea, the rate varying according to the size of the vessel and its means of propulsion, from £22 down to nothing. The scheme is administered by the Fisheries Departments. In the financial year 1955/56 the total white fish subsidy paid in the United Kingdom was almost £2¼ million.

Processing, Exports, Distribution, etc.

By comparison with the extensive services which the Government performs in connection with the catching side of the sea fish industry, its activities in regard to what happens after the fish leave the quayside are only slight. There are, of course, numerous governmental services which affect the distributive side but which are in no sense peculiar to it, e.g., the control of markets and the enforcement of minimum standards of cleanliness and working conditions in shops and factories. Such services are the concern of local councils and government departments other than those primarily interested in fisheries.

Among the subjects which can be mentioned under the rather diffuse heading of this section is the encouragement of co-operative marketing among inshore fishermen. This is undertaken by non-governmental organizations which receive financial assistance from the Government.

The Herring Industry Board has notable interests in the processing trade. The Board pioneered the practice of quick-freezing and operates two large plants. In addition to these and its oil and meal factories the Board also lets mobile quick-freezing equipment to traders and finances the purchase of curing equipment. The White Fish Authority does not itself operate in this field, but both it and the Herring Industry Board are concerned with encouraging high standards of processing, and the Authority offers loans for the provision, equipment, reconditioning and improvement of processing plants.

The White Fish Authority gives direct aid to exporters of white fish by refunding its general levy on fish sold abroad. The Herring Industry Board is particularly concerned with promoting exports of pickle-cured herring. The Board buys all cured herring and thereby becomes responsible for selling it abroad; the home demand is negligible. The curers receive a price based on the negotiated price of the herring at first sale, the curers' production costs, and the overheads of the exporting organization; in other words, the Board pays the curers a fee for the work done. Most of the profit made by the Board is distributed to the curers as a bonus, but a proportion is retained to help finance future years' operations.

Both the Herring Industry Board and the White Fish Authority spend a good deal of money on advertising, the former naturally concentrating on herring, while the latter merely glorifies fish in general.

Statistics and Economic Investigation

British fisheries statistics are overwhelmingly statistics of production, and almost all of them are collected without the use of compulsory powers. There is, in fact, a close and happy co-operation beween the trade and the Government in this respect. Sta-

tistics of production are collected primarily in order to provide a complete record of landings and values of fish at each port, but the statistics are also used for the scientific purpose (which indirectly has a big economic significance) of charting the areas where the fish are caught.

The main statistics collected by the Fisheries Departments in respect of each landing by vessels over 40 ft. in length cover details of the vessel, particulars of the grounds visited, the method of fishing, the number of hours fished, the number of lines or drift nets used, the number of hauls made and their average duration, the length of the voyage, and the weight of each species of fish landed. The returns are fed into Hollerith electronic computing machines at headquarters, which make various combinations of information at high speed. The main tables are issued and distributed monthly free of charge and the annual volumes are sold by Her Majesty's Stationery Office. The Herring Industry Board and the White Fish Authority rely to a large extent on the Fisheries Departments for the basic statistics of production, but they supplement them with figures on the distributive side, and they publish, in their annual reports, some statistical information which the Departments collect but do not publish or do not publish in the same form, Other official sources of relevant statistics are the Board of Customs and Excise, the decennial census reports, and the more frequent censuses of production and distribution.

A great effort is now being made to fill in the gaps in understanding of the economics of the sea fish industry. Various investigations of a fundamentally statistical and accounting nature are being carried out by the Herring Industry Board and the White Fish Authority. They include enquiries into the costs and earnings of certain sections of the catchers, and the collection, through registration and sample surveys, of basic data about the structure of the distributive side of the industry.

Research

Research into marine biology and related sciences and into the efficiency of methods of catching fish is carried on by the two Fisheries Departments. A great deal of fundamental marine research is also undertaken in universities and private research institutions, which are helped financially by the State. Until very recently almost all the money spent on research by the Fisheries Departments and all that given to independent marine research institutions came from a special Development Fund, disbursed by a body of Development Commissioners. The Departments now finance their own research, but the duty of recommending and making grants to independent institutions and to individual postgraduate research students remains with the Development Commissioners. The influence of the previous arrangements is also re-

flected in the continued existence of an Advisory Committee on Fishery Research appointed by the Development Commissioners, which plays a very important co-ordinating rôle. The scientists of the Fisheries Departments play their part in the work of the International Council for the Exploration of the Sea, the Permanent Commission set up under the International Fisheries Convention of 1946, and the International Commission for the North West Atlantic Fisheries.

Much of the research into the treatment and handling of fish from the time they are landed on the deck of the fishing vessel, is carried on by the Fish Division of the Food Investigation Organization of the Department of Scientific and Industrial Research, which is particularly engaged in solving problems of storage and transport, refrigeration, canning, curing and dehydration of fish. The Fish Division works closely with the fish trades and with the Herring Industry Board and the White Fish Authority. The latter bodies are, in this context, mainly interested in pilot commercial experiments, the next stage after the development of applied research by the Fisheries Departments and by the Department of Scientific and Industrial Research.

About £500,000 are at present being spent annually by the Government in Britain on research which will benefit the sea fish industry.

* * *

DRIFT BOTTLE EXPERIMENTS - MAURITANIA

Drift bottle experiments have recently been initiated by the Fisheries Laboratory of Port Etienne, along the Mauritian coast. Of these bottles 8,000 were released; they are of 33 cl. size, and painted white.

Anyone finding such a bottle is kindly requested to complete the card inside, and mail it back to the Laboratory. Further similar experiments will be carried out during the International Geophysical Year.

A GEAR RESEARCH VESSEL

In 1956, the Royal Swedish Board of Fisheries requested FAO to prepare preliminary plans for a fisheries research vessel to carry out gear research and experimental fishing. No basic study of the design requirements for such a vessel existed. It was felt, therefore, that FAO naval architects should make a study in the general interests of the Organization.

Sketches of alternative layout and deck arrangements were first made, then preliminary drawings were prepared and discussed with officers of the Royal Swedish Board of Fisheries. On the basis of these discussions, the final project — 15 drawings and a 62-page outline specification — were submitted to the Swedish Government.

Local conditions had to be taken into account in preparing the designs. It was suggested that the vessel be built of wood instead of steel, because that would be cheaper in Sweden. The length decided on was 90 Swedish feet, corresponding to 87.7 English feet, so that the boat would be larger than the biggest commercial fishing boats being built today. The shape of the hull was designed in accordance with modern practice. One consideration in designing this hull shape was to persuade Swedish fishermen to adopt similar improved hulls in the future. It was proposed to install a semi-Diesel-type main engine, which is most common in Swedish fishing vessels.

Two main types of research were envisaged — gear and fish handling. In addition, provision was to be made for taking biological and oceanographic samples. To carry out different types of fish handling experiments simultaneously, e.g., using normal commercial practices for one batch of fish and new techniques for another, two separate fish holds were designed. This enabled the architects to place an alleyway between the fish holds, thereby establishing a most useful connection line from the bow to the deckhouse.

Deep sea fishing in Sweden is carried out mainly by trawling. Emphasis was therefore put on the installation of instruments to measure the speed of the ship and the output of the engine. It was suggested that the main engine should be equipped with torque and thrust meters, in addition to a fuel measurement tank, a continuous fuel meter and a precision type of revolution meter. The speed over ground was to be measured by a Decca navigator, and the speed through the water on the surface by a stationary pitot-type log and a portable resistance log.

All deck machinery was to be of the low pressure hydraulic type in which the main engine drives a hydraulic pump. The individual deck gear — such as trawl winch, line hauler, windlass — is driven by hydraulic oil engines activated by the pump. A large

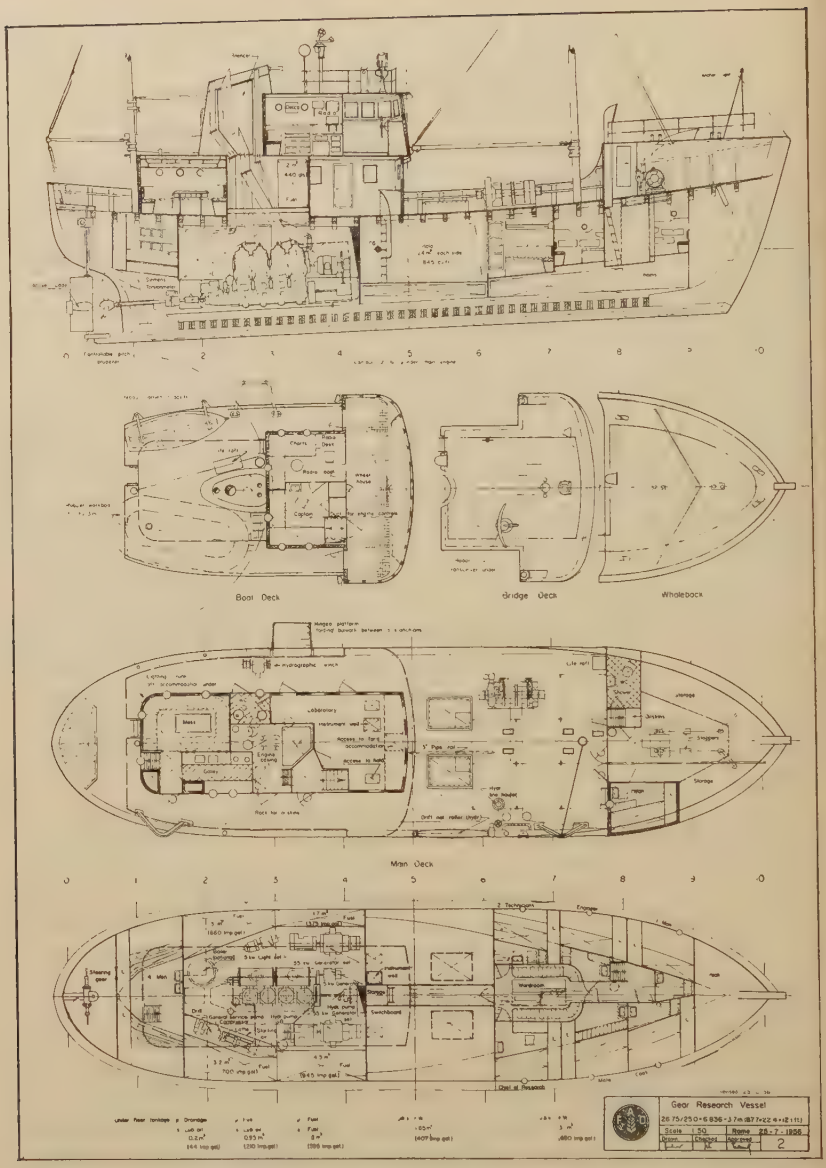

Fig. 1. Profile and deck plans of new trawler

rubber boat was provided to carry out echo sounder measurements above the gear being dragged by the boat. Inflatable rubber life rafts were specified.

The general arrangement drawing (*Figure 1*) shows the layout of the ship. The crew are placed in one-man cabins. The perspective line drawing (*Figure 2*) gives an indication of the lines which were developed on the basis of data from numerous model tests available to FAO. A prismatic coefficient of 0.575 was selected to give a moderate resistance with optimum sea-keeping qualities.

TABLE 1 — MAIN PARTICULARS OF THE DESIGN

	Meters	English feet
Length over-all	26.75	87.70
Length in waterline, CWL	25.00	82.00
Breadth over-all	6.84	22.40
Breadth in waterline, CWL	6.80	22.30
Freeboard to maindeck from CWL, forward at rabbet	2.56	8.40
Freeboard to maindeck from CWL, lowest	1.18	3.87
Freeboard to maindeck from CWL, aft at rabbet	1.75	5.74
Depth of side, midships, from overside deck to rabbet	3.70	12.12
Draft, underside keel, to CWL, aft	3.15	10.32
	Cubic meters	**Tons**
Displacement to CWL	193.5	198.2
Weight, full bunkers and no ice	188.3	193.0
Weight, empty bunkers and 20 tons ice and fish	184.8	189.5
Fuel tanks	18.75	16.40
Fresh water tanks	9.90	9.90

TABLE 2 — CALCULATED SPEEDS, TRIAL CONDITION, FULL BUNKERS

B. h. p.	R. p. m.	Calm Water (knots)	Moderate Sea (knots)
420	300	11.3	10.3
340	300	11.1	9.8
300	325	10.9	9.5
250	300	10.4	8.9
200	300	10.1	8.4

TABLE 3 — PERIOD OF ROLL, OVER AND BACK

Full bunkers + 10 tons ice	6.54 seconds
Empty bunkers + 20 tons ice and fish	7.08 seconds

TABLE 4 — RADIUS OF ACTION
Moderate sea and 40 h.p. auxiliaries

b. h. p.	Nautical Miles
420	2 000
340	2 400
300	2 600

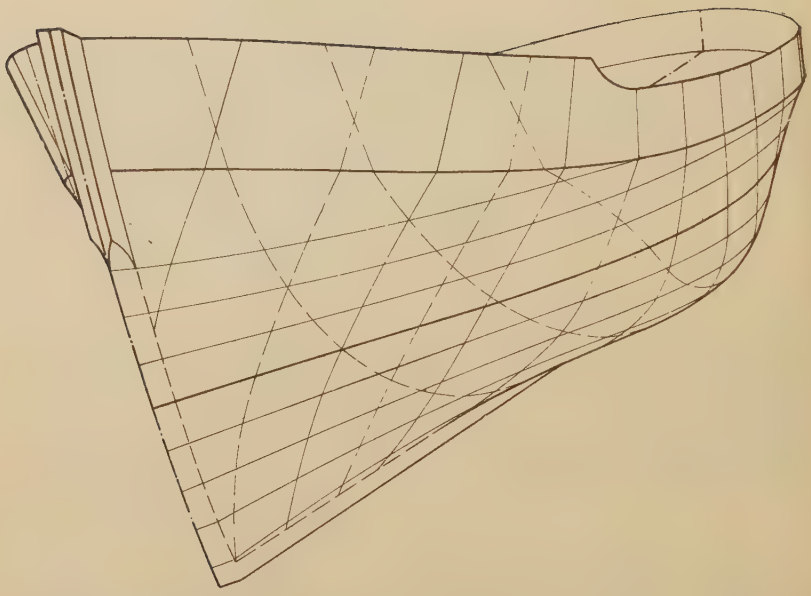

Fig. 2. Perspective of the line drawing developed on the basis of data taken from many model tests.

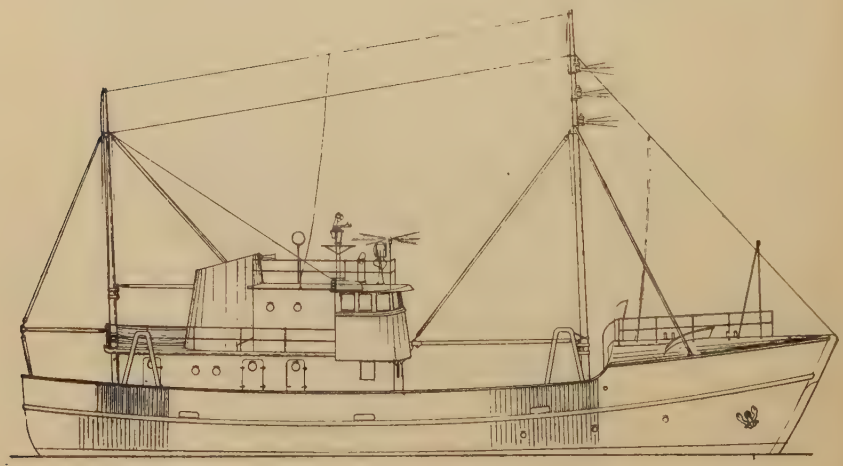

Fig. 3. Profile.

BULK-FREEZING OF FISH *

Progress Report from Working Group No. 4, FAO Interim Committee on Fish Handling and Processing, Presented at the FAO Fish Processing Technologists Meeting, Rotterdam, The Netherlands, 24 to 29 June 1956.

The term " bulk-freezing " refers to fish frozen aboard for subsequent distribution in the thawed state as fresh fish, fish fillets frozen in blocks for fish sticks, products for pet foods and bait, but not to fish frozen in consumer and institutional packs. It is assumed that most frozen fish for further processing will need to be packed in a bulk-like manner.

Bulk-freezing of fish plays an unimportant part in the trade in general (except tuna, herring, salmon and halibut) as compared with the volume of " consumer goods. " There is, however, a potential demand for-bulk frozen fish :

(*a*) for leveling out the fish supply in some processing industries ;
(*b*) for disposing of catches in a simplified manner during gluts, and ;
(*c*) for utilizing abundant resources in remote waters.

This last phase which concerns freezing aboard, covers all aspects from round or dressed fish for the fresh fish trade, to all kinds of semi-finished products for final processing ashore.

The purpose of this survey is to draw a picture of the fish freezing activities in various countries and of the many different aspects of freezing fish in bulk ; it is not intended to cover production and distribution of consumer goods.

I. Commercial Activities

Tuna

Tuna fisheries are an important activity in many regions. The only product worth mentioning is canned tuna meat packed in oil — originally a Sicilian speciality — which has now developed into an item of international importance with main markets in the U.S.A. and Italy. The greater part of the tuna fish are bulk-frozen for the canning industry. About one half of the catch of the coastal fisheries is dispatched fresh to the canning plants, the rest is frozen, mainly in air-blast freezers, for storage and later delivery. The main catches are frozen aboard the fishing vessels, this activity being, in fact, the only bulk-freezing operation at sea practised today on a commercial scale of any importance.

The freezing is performed in a simple manner, by circulating

* by Eirik Heen, Olaf Karsti and Einar Bagge-Lund of the Norwegian Fisheries Research Institute, Bergen, Norway.

brine through steel tanks, fitted with cooling coils, and loaded with the fish. After freezing, the tanks are drained and the fish stored in the tanks until landed.

Approximately 200,000 tons of tuna are bulk-frozen every year.

Herring

Practically all frozen herrings are frozen in bulk for further processing in the canning industry, as well as for smoking, curing and "marinading." Sardines and sprats are frozen as raw material for sardines in oil, while the bigger herrings are used mostly for smoked products and are distributed in a semi-perishable state at local markets.

A rough estimate indicates that the volume of bulk-frozen herrings, sardines, etc., must be at least 100,000 tons, of which Norway produces close on 40,000 tons. Herrings are mostly frozen in brine, a very simple and highly efficient method with individual and high freezing rates, a high capacity and cheap handling.

This product, however, is not well suited for long storage. Even at -13°F. (-25°C.) storage temperature, rancidity is pronounced after six to eight weeks, and this certainly limits the market. Several attempts have been made to improve storage resistance by freezing herrings in blocks, and there are no serious difficulties. But herrings are a cheap commodity and allow only small extra expenses even if improved quality is achieved.

Herrings frozen in blocks with a thickening agent, such as an alginate jelly, have proved to be an excellent product for storage, and have the practical advantage that the individual fish can be separated without thawing out the whole block. Whether or not the advantages will compensate for the higher costs remains to be seen.

Salmon

The most important salmon fisheries are those of the Pacific coasts of Alaska and Canada, where the catch is mainly canned fresh, although in latter years an increasing amount has been frozen for storage and subsequent canning. Brine freezing of salmon in a manner similar to that used for tuna has not been entirely successful, and the general conclusion is that for a high quality product salmon should be canned in the fresh state. On the other hand, experimental work has shown that when precautions are taken, frozen salmon could give a satisfactory canned product — so, in this case, the procedure involved in freezing, storing and packing would also have to be considered, before judgment could be given of the practicability of freezing salmon for the canning industry.

In Europe, salmon is, to a very great extent, processed into a cured, smoked product. Freezing of the fresh fish in the round or dressed form is widely used, and about half the catch is frozen for storage and subsequent dressing and smoking. To obtain high

quality products numerous investigations have been made with the object of determining optimum conditions for pre-treatment, freezing, etc. It was found that salmon should be frozen in the round state, in air-blast, heavily glazed and stored, preferably below-22°F. (-30°C.). Fish so frozen give a high class product when smoked after six months' storage.

Whether the fish should be eviscerated or not would seem to depend on conditions of catching and transportation.

Halibut

Thirty years ago a considerable fishery for halibut existed in Greenland waters, and the catch was frozen aboard depot ships. The fish were frozen in brine and distributed in Europe in the fresh state as soon as possible after landing. The product seems to have been well accepted. This activity ceased when overfishing depleted the stocks.

Since the war fishing for halibut in these waters has re-started, but now the catch is frozen aboard the fishing vessels. These vessels are medium-sized, long range boats around 100 ft. (30.5 m.), equipped with a 20 to 40-ton capacity freezing compartment primarily for frozen bait, and further used for freezing the comparatively limited quantities of halibut.

In the much larger fisheries for halibut in Alaska and the U.S.A. the greater part is frozen for transportation and distribution.

White Fish

The cod species are generally marketed fresh or salted. The frozen products from these fishes are mainly " consumer pack, " or prepared fillets.

In the first postwar years a considerable quantity of bulk-frozen cod was found on the European market, but the volume soon decreased. White fish caught in far distant waters are usually bulk-frozen, but a compromise between profitable time for fishing and the perishability of iced fish has to be reached.

The U.S. Fish and Wildlife Service has developed a brine-freezing system, which has been installed on their research vessel *Delaware*. In Britain, there are two experimental trawlers, equipped with an indirect contact-freezer for freezing round fish in blocks.

There are many projects for the purpose of utilizing bulk-freezing of white fish, some in combination with the landing of iced fish from the last days' catching, and others in combination with salting on board. The practicability of these systems depends very much on the local conditions for fishing and marketing.

The next step in preparing a semi-finished frozen product aboard has materialized in the *Fairtry* and in a number of Russian vessels. In a factory ship of the 3,000-ton size, the aim is to produce at sea the final product ready for consumer use, i.e., not a semi-finished bulk product.

II. Bulk-Freezing Methods

(a) *Brine Freezing*

Brine freezing is the freezing of fish in direct contact with a refrigerated liquid. Of liquids that may be considered suitable for contact with food, brine of a sodium chloride solution is by far the most important and probably the only one which may be used on an economical basis. Occasionally smaller quantities of other ingredients may be added. With this brine, temperatures of about 1.4°F. (-17°C.) are usually obtained. To keep salt penetration into the fish at a minimun, the temperature should be at or near the freezing point of the brine, the latter acting as a refrigeration carrier between the cooling coils, in which the evaporation of the refrigerant takes place, and the fish.

There are two main methods of applying brine to fish :

(*i*) by spraying ;

(*ii*) by immersion.

Both methods require only fairly inexpensive apparatus ; they are simple to operate and high capacities may be obtained in a comparatively small plant.

Brine freezing is generally used for herring in Norway during the great winter fisheries on the west coast, where huge catches have to be dealt with in a limited time. In early summer, large catches of mackerel are also frozen in this way.

The freezing is usually accomplished by packing the fish into 110 lb. (50 kg.) wooden boxes stacked 3 or 4 high in long rows. Cold brine is then sprayed over the boxes, which are slatted to allow the brine to pass from one to the other. A perforated, distributing plate is placed above the boxes to ensure better distribution from the sprays. The freezing time is usually 1 to 2 hours with a brine temperature of 1.4°F.

The second method — immersion — is less used. It is not quite as simple as spraying, although some of the drawbacks of this method are avoided, such as pumping difficulties due to clogging of the pipe lines with fish scales; foaming, and uneven distribution to the various boxes.

In the immersion plant the boxes are usually placed in a central open duct where they are pushed forward continuously under the surface of the brine, which is forced up through the cooling coil section by stirrers. The brine circulates over the boxes and down through the middle section back to the stirrers.

Another important use of brine freezing is made in freezing catches of tuna aboard tuna clippers off the west coast of the U.S.A. and Canada. The fish are placed in large tanks filled with circulated, precooled sea water having a temperature of 30.2°F. (-1°C.), and in 1 to 3 days are cooled to as near freezing point as possible. Often the brine is drained and the tank filled with more fish before

new cold brine is pumped in, in order to fill the tanks completely. The purpose of the precooling is to close the pores in the skin and wash away all blood and slime before stronger brine is applied. At the end of the cooling period, the sea water is drained, usually by pumping overboard, and new cooled sea water is pumped in.

By the addition of salt the concentration of the brine permits a cooling to at least 14°F.(-10°C.) without freezing. About 99 lb. (45 kg.) salt for each ton of fish is usual. The brine is cooled to 17.6°F. (-8°C.) and maintained at this temperature for 48 hours, whereby the fish are frozen solid. The temperature in the center of the fish should be below 23.9°F.(-4.5°C.) to freeze the water in the muscles.

After freezing, the brine is pumped out and the tanks, fitted with refrigeration pipe coils on the walls, are used as refrigerated storage for the remainder of the voyage.

The fish freeze together and must be thawed out by pumping sea water through the tanks before unloading. To prevent this freezing together some ships have installed separate air cooled storage rooms and used fewer fish in the tanks, but it has mostly been found that re-stowing of the fish at sea is too cumbersome.

Several devices have been developed for brine freezing smaller fish at sea, such as the white fish species, so that the catches may be handled without the use of excessive manpower.

Some French trawlers formerly used the Piquet method of freezing consisting of a rotor in a horizontal cylindrical tank. The rotor had perforated wings dividing the tank into 6 to 8 sectors or compartments. The fish were dropped into the top section and followed the chamber through the brine in the tank, finally being discharged automatically on the opposite side.

A somewhat similar device has been installed in the U.S. experimental trawler *Delaware*. Here, perforated baskets containing the fish are fastened to two continuous chains dipping the fish into the brine and out again. Each basket holds about 300 lb. (136 kg.) of round fish giving the freezer a total capacity of 4,400 lb. (2,000 kg.). The loading density of about 20 lb./.sq. ft. (320 kg./m^3) provides sufficient space for agitation of the fish in the baskets. The refrigeration plant is of the ammonia absorption type. The fish brought ashore frozen in this manner are intended for further processing by being thawed, filleted and again frozen.

The main disadvantage of brine freezing is salt penetration into the fish, which contributes to rancidity of the fat and thereby lowers the storage time. The more fat the fish contains the more pronounced this action will be.

Research on this factor of salt penetration has been carried out on the *Delaware*. The fish were frozen whole, since absorption of salt is comparatively high at cut surfaces and visceral cavities. The fish after having been thawed in fresh water at 46.4°F.(8°C.) and 66.2°F.(19°C.), respectively, gutted, filleted and again frozen, were reported to compare favorably with iced fish caught at the same time.

In connection with brine freezing, the method developed by Zarotschenzeff, consisting of spraying the brine in a fine mist in contrast with the drop-spraying method, should be mentioned. The plant has three processing steps : washing with fresh water, showering with brine, and rinsing off the traces of salt with fresh water.

(*b*) *Air-blast Freezing*

In air-blast freezing, air is used as a carrier of heat from the fish to the refrigeration coils. The air is circulated by powerful ventilating fans over the refrigeration coils, through the freezing tunnel and thence back to the intake side of the fan. The fish to be frozen are placed in the freezing tunnel, usually on shelves mounted on wagons or, in the case of the larger fish, hung from racks.

The simplest form of air-blast cooling consists of blowing cold air through ducts into a larger room and circulating the air back to the coil again. This, however, gives uneven cooling and is not very satisfactory. The more efficient tunnel freezers are arranged in a variety of ways although the principle is the same.

The air-blast tunnel freezer may also be arranged with a more or less continuous operation where the food to be frozen is placed on waggons or belts and is conveyed through the tunnel either continuously or at intervals. The advantages of this method over brine freezing are flexibilty and, to a certain extent, better sanitation. The disadvantages are poor heat transfer to and from the air, formation of ice on the cooling coils, all resulting in larger plants and slower freezing and, in addition, drying out of the food by absorption of moisture in the air. The fish will thereby lose some of their natural flavor. The remedy is to have the fish sealed against the air as closely as possible by using moisture proof wrappings. Glazing after freezing will partly prevent drying out in storage. When freezing fish in bulk, however, use of wrappings usually becomes impractical and glazing is commonly employed.

An air-blast generated by portable fans has been used to speed up the " sharp-freezing " technique. The food to be frozen is placed on refrigerated pipe racks, shelves or plates. The air-blast improves the rate of freezing considerably.

The use of air-blast for the bulk-freezing of fish is found mainly in plants ashore and on fishing boats dealing with large fish, such as halibut, tuna and salmon.

In Norway, a part of the tuna fished near the coast is frozen in air-blast plants ashore. Each fish is hung by the tail from steel scaffolds on wheels and frozen in tunnel freezers.

Halibut caught in Greenland waters are frozen in a similar manner aboard the fishing boats and stacked in the storage room after freezing and glazing.

Salmon fished on the Pacific coasts of the U.S.A. and Canada are frozen, stacked on wagons furnished with shelves or racks.

The British trawlers *Fairfree* and *Fairtry* are using air-blast

in combination with refrigerated shelves to produce frozen packs of fillets weighing 7 lb. (3.2 kg.), and, therefore, may be considered on the borderline between consumer packs and bulk frozen fillets in blocks.

In the same category comes the Russian factory ship, *Pushkin*, which freezes fillet packs weighing 7½ lb. (3.5 kg.), the principle being similar to that used in the British ships.

In the cases mentioned above the smaller packs are assembled in a larger carton weighing about 66 lb. (30 kg.).

(*c*) *Indirect Contact Freezing*

Indirect contact freezing is a system whereby the frozen food does not come in direct contact with the cold bearing medium, but is kept apart by a metal plate which forms walls in adjacent chambers.

The refrigeration medium coming in contact with the wall may be either a cooled brine, or the refrigerant itself undergoing direct evaporation.

Most widely used is the multi-plate freezer where the food is placed between metal plates having internal channels with refrigeration liquid which may be either of the types mentioned above. This type of freezer, although originally developed to freeze a ready consumer pack, has been used to an increasing extent for the freezing of fish in larger packs and blocks which rightly should come into the category of bulk-freezing.

The gap between the plates can be widened so that the packs may be inserted and then tightened, usually under hydraulic pressure. Thereby a good contact is formed between the frozen food and the plates. This contact is important since the heat transfer here takes place only by conduction through the metal wall. The pressure on the fish is usually 0.1 atmospheres or less.

Multi-plate freezing, which tends towards bulk-freezing in the form of fillet blocks for later cutting into smaller units, such as fish sticks and the like, has developed into a large industry in North America and some European countries. The blocks are formed in various manners by using trays, frames, etc., which are placed between the plates in the freezer.

Various attempts have also been made to mechanize the packing of the fillets into uniform units forming blocks when frozen, such as cutting a column of fillets in regular heights by a rotating knife having a reciprocating motion. In another process fillet trays filled at random are placed on a belt and leveled off to uniform quantity by passing the trays under the rollers.

A special vertical plate or pocket freezer has been developed by the Torry Research Station, Aberdeen, Scotland, and modifications of the arrangements have been installed in the British trawlers *Sir William Hardy* and *Northern Wave*. The freezer is aimed

at freezing round fish in blocks aboard far distant trawlers and stowing the blocks in the refrigerated hold until brought ashore where the fish are thawed out and distributed. The apparatus consists of parallel plates spaced the thickness of the block apart. The plates are refrigerated by direct expansion of the refrigerant. For removal of the blocks, hot gas from the compressor is circulated through the plates at the same time as the space between the plates is widened at the bottom to form a taper by a jacking system. The blocks weigh about 60 lb. (27 kg.).

In Norway, where market requirements are somewhat different, the Fisheries Research Institute in Bergen has also developed a vertical pocket freezer which may be used for the freezing of fish fillets in blocks and, if so required, also for round fish. The underlying principles are that the fillets should be subjected to a pressure both before and during freezing in order to produce a homogenous block free from air pockets, and that the freezing chamber should have fixed dimensions except in one direction. This one direction is one of the smaller sides, in order to cut down the waste to a minimum when the block is divided into smaller units. The pressure is obtained from a close-fitting piston which enters the form and permits packing of it by degrees. The blocks weigh about 110 lb. (50 kg.) each.

For the freezing of round fish in bulk, the vertical plate freezer of Norwegian design, originally developed for the freezing of whale meat, has been suggested.

The bulk-freezing of fillets in factories along the Norwegian coast has followed the methods established in the U.S.A., and where multi-plate freezers had previously been installed for the production of consumer packs, production of blocks has now been taken up. The fillets are hand-packed into frames with a lose metal bottom and cover, and are frozen in the horizontal plate freezers. The removal of the covers is performed with the blow of a hammer which also opens a lock in the frame and the block is released. The blocks which usually weigh about 44 lb. (20 kg.) are glazed and packed in cardboard boxes before going to refrigeration storage. These blocks may be used as raw material for a great variety of consumer pack sizes and forms.

In the indirect contact freezing method it is essential to obtain a good contact between the cold metal and the fish. When freezing round fish, a filler medium, such as water or alginate, would improve such a contact. All such fillers would form a coating around the fish similar to glazing and would thereby improve keeping qualities.

For gutted lean fish a fairly good contact may be obtained dry, but some improvement is obtained by a filler. It is unimportant which filler is used.

For the freezing of whole herrings, however, fresh water gives a better quality than sea water. Alginate jellies are also advantageous but more costly.

III. Economic Aspects of Freezing at Sea

Round Fish

Freezing of round fish at sea, practised to a considerable extent by French and Italian vessels for many years, is no longer popular. The limitations lie in the competition with iced fish; freezing is worthwhile only when there is abundant fishing in the remote waters; and icing is often insufficient to bring the fresh fish ashore. On the other hand, when there is a period of rich fishing, as at present in Greenland waters, and the fish caught are suitable for salting, the icing method of preservation may be the more suitable. The most attractive fish economically for salting is cod. Where there are rich resources of other species, such as rosefish (ocean perch), haddock or catfish, freezing the round or dressed fish may be a paying proposition.

In principle freezing would be a more expensive procedure than chilling. The limitation of icing lies in the time the vessel can stay on the fishing grounds. It is generally accepted that fish should not be distributed as fresh when they are 8 to 10 days "out of the sea." In fact, it is felt that this is still too long and that these "old" fish provide the main reason for the undoubtedly weak interest in fish eating in the western world.

Round frozen fish, unless special precautions are taken for protection, have also a limited storage life, but this is of a different order of magnitude than the storage life of more perishable iced fish. From an economic point of view all kinds of round frozen fish and herrings, as long as they have to compete with the fresh items, involve a considerable risk. An example is frozen herring produced in Britain. An excellent product is obtained from herrings caught in the autumn but at some extra cost, an there is always the big risk that stocks will not be sold by February when cheaper, fresh herrings may be obtained from the Norwegian winter fisheries.

Freezing Fish Fillets Aboard Ship

Similar equipment and procedures as for land-based filleting plants are used for the freezing of fish fillets aboard ship at sea. This requires quite a lot of space and accommodation for increased crew, hence the supertrawlers of the *Fairtry* and *Pushkin* type.

The advantage of freezing fillets aboard is apparent in that a cargo is carried with a unit value of 2 to 3 times the round fish — depending on how far the product has been brought up to a finished consumer pack. So far only two French vessels produce a part of the catch in the consumer pack form, both the British and Russian vessels preparing a more bulklike product.

There has been much speculation about the prospects of freezing such products at sea, but to the authors it seems definite that

as soon as mechanization of the whole process is more developed and the product which emerges is brought to the consumer level, freezing aboard vessels of " normal " size, or at optimum size for fishing, will be the most profitable form of utilizing the resources in distant waters.

There may be a wide variety of forms of the product — from the boneless fillets to the split fish with none, or little, pretreatment. The technologist must also consider factors other than purely technical ones. He cannot choose form and size and dressing of the product merely from what is technically more feasible. The acceptance of the products is governed by the habits and prejudices of the consumers.

Filleting machines are now available for most of the common fishes, and have proved reliable for operation on board ship. This is certainly one of the main processes in a mechanized production line. The next step is to find forms and means of avoiding manual packing.

Fisheries Division Activities

FAO Regional Conference for Latin America

The Fourth FAO Regional Conference for Latin America was held at Santiago from 19 to 30 November 1956, at the invitation of the Government of the Republic of Chile. During the Conference, an examination was made of the general agricultural situation and outlook in the region, including the production, distribution and consupmtion of agricultural, fisheries and forest products. Recommendations were made both to member countries in regard to their national plans for the development of agriculture, and the Director-General of FAO in regard to the program of work of the Organization for the period 1958/59.

The Conference was attended by 83 delegates and advisors representing 20 Member Governments, and by observers from the United Nations, the International Labour Office (ILO), the Organization of American States (OAS), the Inter-American Statistical Institute (IASI), the Holy See, the International Health Organization for Livestock and Foodstuffs, the Intergovernmental Committee for European Migration (ICEM), and the Inter-American Institute of Agricultural Sciences (IAIAS).

The inaugural session, at which the President of the Chilean Republic was present, was held in the Salon d'Honneur of the Congress ; the speakers were the Minister of Foreign Affairs, the

Minister of Agriculture for Chile and the Regional Representative of FAO for Latin America.

The Minister of Foreign Affairs expressed his pleasure that his country had been chosen as the headquarters of the Conference. He drew attention to the fact that the Conference coincided with the establishment of the FAO Regional Office for Latin America in the capital of Chile, expressed his thanks for the distinction which both these actions implied, and felt that this was an acknowledgment of Chile's goodwill and desire to co-operate with FAO. After welcoming the delegates of other Governments and the staff members of FAO taking part in the Conference, he recalled the birth of FAO at the end of World War II and the reasons for its establishment, taking into account the exceptional economic and agricultural conditions then prevailing in the world. In declaring the Conference open, the Minister expressed the wish that important conclusions and recommendations would be reached which would benefit all countries in the region.

The Minister of Agriculture also welcomed the delegations in the name of his Government and expressed his best wishes for the success of the Conference. He briefly recalled Chile's relations with FAO and the contribution the Organization has made, jointly with other international organizations, to the agricultural development of his country. The agricultural program, which Chile is at present carrying out, is based on the recommendations of FAO and of the International Bank. Its objectives are to increase agricultural production through better technical and other measures contributing to a higher standard of living and better nutrition. Although considerable efforts will be needed to reach the final objectives of the plan, significant progress has already been made.

The FAO Regional Representative, in the name of the Director-General of FAO, thanked the Chilean Government for its hospitality and emphasized that greater co-ordination between the national agricultural programs and those of FAO should result from the present Conference. FAO regional conferences are advisory in nature, both to Governments and to FAO. On the latter side, the advice of the Conference would be sought on the program of FAO for 1958/59. He recalled the purposes for which FAO was formed and stressed the magnitude of the problems which had to be faced to meet the growing needs of the human race.

The Technical Assistance Program was a principal means of reaching FAO's objectives, and the connection between this program and the regular program of FAO was becoming closer. Collaboration with other international and regional bodies, such as the Economic Commission for Latin America (ECLA), OAS, IAIAS and the International Co-operation Administration (ICA), was also increasing to the mutual benefit of all these organizations.

The principal item under discussion on fisheries was "The Use of General Fisheries Surveys as a Basis for Regional and National Development Planning." In the background paper on

this item, attention was drawn to the necessity of following the initial survey stage by one of planning and implementing, choosing between alternative development policies for fisheries, in conformity with the general economic policy of the country in question and computable with its physical, technological, economic and social potentialities. The later stages of such a program should be subject to revision, if necessary, in the light of the experience gained in the earlier stages, but these revisions should not, if the program is carefully planned and executed, be the result of avoidable failures.

It was pointed out that this approach already existed at the national level and at least one group of countries in the Region has found it desirable to co-operate closely to this end. FAO assisted these efforts by the assignment of experts and through the development of methods. This is aided by the considerable experience which FAO has accumulated during the several years of active endeavor in the Region. Limiting factors in the formulation of realistic plans were the lack of basic information and the scarcity of trained fisheries people in the countries themselves, the former deficiency being largely a consequence of the latter. FAO was attempting to assist countries by conducting training centers for fisheries workers and administrators, two such centers having taken place in the Region in the past five years. This training has been furthered by the assignment of 25 technical assistance fisheries experts to 13 countries of the Region during the same period.

The Chilean Delegation stated that fisheries industries in their country had developed to an extraordinary extent during recent years and special legislation had been introduced in favor of fisheries development. Technical assistance from FAO and the active co-operation of national institutions had been important factors in achieving this progress and the resulting industries promised to constitute one of the principal economic activities of Chile. To support this growing industry and to further fisheries development, educational work was being undertaken by Chilean universities and research institutions. Nevertheless, a serious crisis was becoming apparent in the Chilean fisheries industries and a more intensive program of technical aid was requested from FAO in order to assist the Government in overcoming these difficulties.

Finally, the Chilean delegate introduced a resolution calling upon the countries of the Region to attach the greatest importance to bringing into being the Latin American Fisheries Council, the constitution of which had been drawn up at a special meeting in Lima, Peru, in 1951, which had also been recommended for adoption at the Third Regional Conference in Buenos Aires in 1954. The Delegation believed that such a fisheries council would, in a large measure, contribute to the solution of the fisheries problems which confront all countries of the Region.

The Delegate of Ecuador drew attention to the great interest of his country in the development of fisheries. Steps were being

taken to develop a fisheries policy and his Government was anxious to carry on the basic studies, indispensable to the development of the industry. He would like to call upon the skill and experience of FAO to help in this task. The Government of Ecuador was, with FAO's assistance, already developing a marketing, refrigeration and processing unit based upon one of its principal fishing ports, and hoped to extend its activities to other landing places in the near future. It was also interested in developing the inland fisheries in rivers at high altitudes in order to increase the food available to the populations lacking animal protein.

The Delegate from Ecuador also felt that the Latin American governments should establish programs for biological research to enable them to intensify fisheries development without endangering the resources. He, therefore, introduced a resolution to the effect that FAO should assist the countries of the Region with the development of their research and investigational programs and that scholarships should be made available for the training of professional personnel.

Since certain countries with coasts on the Pacific Ocean share common fisheries resources, the Delegation of Panama proposed that these countries should, pending the formation of the Latin American Fisheries Council, take immediate interim measures to convene a meeting to establish a program of investigation of their common aquatic resources, through the co-ordination of their technical assistance and educational programs. The Panamanian Government offered full co-operation in such a scheme through the utilization of the facilities in its National Fisheries Laboratory, and its good office in approaching other sources of technical assistance in order to base on that Laboratory a concerted program of fishery investigation in the interest of these neighboring countries.

The Peruvian Delegation called attention to the fact that an increased supply of animal proteins would depend largely on the availability of protein from sea food. It became necessary, therefore, to undertake basic studies of fisheries resources with a view to their development and conservation. The Delegation proposed that the Conference should recommend that the studies for the development of the fisheries industries, should be integrated with the general economic policy of each country, and that special attention should be given to the development and conservation of biological resources.

Latin America

Dr. Cecil Miles, FAO Regional Fisheries Officer for Latin America, represented the Organization at the Meeting of the Economic Co-operation Committee for the Isthmus of Central America (CAIS), which took place in Guatemala City, 18 to 24 February 1957. The Meeting approved the recommendations made in a FAO Report on Fisheries of Central America with regard to the 1957 Program

of Technical Assistance to the area. The next meeting will reconsider, after the results of the 1957 preliminary studies are known, the implications of long-term plans for fisheries development in the region as they are suggested in this FAO Report.

Regional Office for the Near East

Mr. M. Girard, Regional Officer for the Near East, visited France and Monaco during January 1957 ; in Banyuls he met Prof. G. Petit, General Secretary of the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM) ; and in Monaco he consulted Mr. C.C. Solamito, Private Counsellor of Prince Rainier and Chairman of ICSEM, regarding co-operation between the Commission and the General Fisheries Council for the Mediterranean (GFCM), and on the convening of a joint session of the joint committee of the two bodies.

Mr. Girard then returned to Headquarters, Rome, for a meeting of the Executive Committee of GFCM.

Biology Branch

In order to co-ordinate certain aspects of the work of the Branch, Dr. G. L. Kesteven, its Chief, visited France and the U. K. in December last. In Paris he had discussions with the UNESCO Department of Natural Sciences regarding collaboration between themselves and FAO in the field of marine sciences, especially with regard to the marine disposal of radioactive wastes. On his return journey from the U.K. he attended a special meeting on this subject with UNESCO in Paris, and FAO was invited to send a representative to the meeting of the UNESCO International Advisory Committee on Marine Sciences, Gothenburg, Sweden, in January 1957.

Dr. Kesteven visited the Scottish Home Department Marine Laboratory, Aberdeen, which is under the direction of Dr. C. A. Lucas, who represents the International Council for the Exploration of the Seas (ICES) on the Steering Committee for the ICNAF/ICES/FAO Meeting on Population Dynamics and Selectivity of Fishing Gear, to take place in Lisbon, Portugal, from 27 May to 3 June 1957. Dr. Kesteven also visited the Fisheries Laboratory, Lowestoft, England, to discuss the activities of the Laboratory in fisheries biology, and their contribution to the Meeting. The Steering Committee met in Rome, from 11 to 13 February 1957. Mr. Lionel Walford of the U.S. Fish and Wildlife Service represented ICNAF and Dr. Lucas, ICES.

T. Laevastu, fisheries biologist, Marine Fisheries Section, represented FAO at three meetings in Gothenburg, Sweden, in January 1957. The Working Group on Oceanography of the CSAGI (Comité spécial pour l'année géophysique internationale) was held

from 15 to 17 January, followed on 18 January by joint meetings of the UNESCO International Advisory Committee in Marine Sciences (IACOMS) and the first Session of the newly established Special Committee for Oceanic Research (SCOR), which is made up of members of the International Council of Scientific Unions, the UNESCO IACOMS, and others. These meetings dealt with international work in oceanography in connection with the International Geophysical Year, and means of promoting international development in this field. A special meeting was called for 19 to 20 January by Dr. R. Revelle to discuss the problems of the oceanic disposal of radioactive wastes, Mr. Laevastu presented for discussion a paper prepared by the FAO Biology Branch, entitled " Preliminary Contribution to the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) on the Specific Questions Concerned with the Oceanography and Marine Biology in respect of Disposal of Radioactive Wastes. " As a preliminary report to the UNSCEAR Meeting to take place in April 1957, Mr. Laevastu was asked to summarize the discussions in Gothenburg, and the paper, " Present State of the Problems on Oceanic Disposal of Radioactive Wastes " was prepared.

S. J. Holt, fisheries biologist, Marine Fisheries Section, was assigned as instructor at the International Training Course in the Dynamics of Fish Populations, held in Lowestoft, England, from 20 February to 6 March 1957. In September 1955, the Permanent Commission of the International Fisheries Commission of the International Fisheries Convention (1946) established an ad hoc Committee to receive and report on information concerning :

(*a*) the 50% release lengths for different trawl cod end meshes of fish species, the landings of which are regulated under the Convention ;
(*b*) the immediate and long-term effects of fishing on the stocks, and
(*c*) the relation of minimum size limits to these results.

The Committee presented its report to the Commission in May 1956. It has now been published in several languages of the member countries and, as the Chairman, Mr. Gunnar Rollefsen said, the results contained in it " will almost certainly serve as leading principles for future work in fishery regulation. " These results were based on methods of data analysis and assessment developed primarily in the U.K. since the end of World War II and, in order to increase the understanding of these methods in other countries, the Permanent Commission asked the U.K. to organize a training course for selected scientists from the member countries. This was agreed, and the International Training Course in the Dynamics of Fish Populations was arranged from 20 February to 7 March 1957. There were 25 participants in all, from Canada (Newfoundland), Denmark, France, the Federal Republic of Germany, the Netherlands, Norway, Portugal, Spain, Sweden, the U.K. and the

Secretariat of the International Commission for the Northwest Atlantic Fisheries (ICNAF). Participation was not restricted to these scientists concerned with fisheries regulated by the Permanent Commission ; indeed, the Course provided a most welcome and almost unique opportunity for discussion of population problems between research workers in such diverse fields as whaling, shellfish, and fresh-water research. In addition to Mr. Holt, the instructors were Mr. R.J.H. Beverton and Mr. J.A. Gulland of the Lowestoft Laboratory, and Mr. B.B. Parrish and Mr. R. Jones of the Marine Laboratory, Aberdeen.

H. Rosa Jnr. of the Branch attended the Ninth Annual Meeting of the Gulf and Caribbean Fisheries Institute in Nassau, Bahamas, from 26 to 30 November 1956, which took place simultaneously with the meeting of the Shrimp Association of the Americas, the Southeastern Fisheries Association, the Atlantic States Marine Fisheries Commission, and the International Oceanographic Foundation. At the meeting, Mr. Rosa described the activities of the Organization, mainly in regard to the Western Hemisphere and the Survey of Living Aquatic Resources. The next meeting of the Institute will take place from 11 to 15 November 1957, at Miami Beach, Fla., U.S.A.

A technical assistance expert, T. H. Butler of the Biological Station of the Fisheries Research Board of Canada, Nanaimo, B.C., took up a 12-month assignment in Indonesia in February 1957, on behalf of FAO. He is to advise and assist the Government in planning and carrying out a survey to locate shrimping grounds in Indonesian waters, and to assess the magnitude of these stocks.

Other marine fisheries projects continue in Brazil, Panama/ Costa Rica, the Philippines, Turkey and Venezuela.

William Dill, senior fisheries biologist, Inland Fisheries Section, attended the first meeting of the Working Party for the Limnological Study of the Danube in Vienna in December last. The meeting recommended the establishment of a body to be known as the Internationale Limnologische Donaukommission, which will complete a limnological study — chemical, biological, bacteriological and ecological — of the Danube, from source to mouth. This study was originally proposed at the Thirteenth Congress of the International Association of Theoretical and Applied Limnology, held in Helsinki, Finland, in July-August 1956, at which Mr. Dill was present. The FAO representative also discussed the question of international participation with regard to inland fisheries, with special reference to the formation of the FAO European Inland Fisheries Advisory Committee, which is to be composed of participants from Member Governments, with FAO functioning as the Secretariat.

Mr. Dill represented FAO at the ECE Consultation with Experts on Water Pollution in Europe, held in Geneva, 12 to 15 February 1957, at which he presented a paper, prepared by the Biology Branch, on " The Role of the Fisheries Division of the FAO

with respect to Water Pollution." En route he stopped in Berne, Switzerland, to discuss the FAO inland fisheries program with the Inspection Fédérale des Forêts, Chasse et Pêche, and the Secretary of the FAO National Committee, with special reference to the formation of the Advisory Committee, and to obtain information concerning the fisheries of Switzerland.

William C. Beckman (U.S.A.), inland fisheries biologist, has returned to Syria to resume his two-year assignment, which was temporarily interrupted last December. In that country, he has been surveying the fish stocks in natural waters with a view to their management and improvement and has been assessing the possibilities of fish culture in ponds. He has drawn up plans for the building of 22 experimental ponds to cover an area of 3½ acres (1.8 ha.) to be stocked with carp. These ponds will be constructed in the Ghab Valley, which is being drained for use as farmland. At present, the local fishermen catch from 400 to 700 tons of fish a year in the marshes of the Valley and, unless these ponds are constructed, this valuable production of fish will be lost.

Other projects in inland fisheries continue in Ceylon, Egypt, Guatemala/Honduras, Iraq and Paraguay.

Technology Branch

The Fishing Boat Section continues its advisory work to Member Governments. Recently, at the request of the Swedish Government, proposals made by the Royal Swedish Board of Fisheries for new machinery for the research vessel *Skagerak* were examined. As a result, FAO proposed the substitution of other machinery costing about U.S. $188,000 less than that originally suggested.

Work is in progress on the design of a 70-ft. wooden research vessel for the Government of South Africa, and a 70-ft. steel vessel for the Government of Nigeria. Eventually it is hoped that the FAO Fishing Boat Section will also be able to prepare designs of 30 ft. and 50 ft. vessels, to form a small research vessel catalogue, covering the 30, 50, 70 and 90 ft., etc., sizes.

In connection with the work of the Branch on fishing boat design, P. Gurtner, FAO naval architect, went to Hamburg, Western Germany in January, to investigate technical problems concerned with the installation of a new type of German-made rudder in fisheries research vessels, and to meet officers of the Hamburg Ship Testing Institute. In England, he visited the Fisheries Laboratory at Lowestoft, to discuss with officials problems concerned with the design and construction of a proposed fisheries research vessel. He also visited Plymouth and then proceeded to Ireland to make various trips on drifters and seiners operating from Waterford.

The preparations for the FAO Fishing Gear Congress, which is to take place from 7 to 12 October in Hamburg, are advancing under the care of H. Kristjonsson, Chief of the Fishing Gear Section.

Official invitations have already been issued, over 100 papers have already been promised, and gear technologists from over 20 countries have indicated that they will attend.

Dr. Birger Rasmussen, of the Institute of Marine Research, Directorate of Fisheries, Bergen, Norway, was at FAO Headquarters on a temporary assignment for the first three months of the year working in the Fishing Gear Section, mainly on the preparation of an annotated bibliography on fishing gear and methods.

The 14-week South Pacific Fisheries Training Course in Noumea, New Caledonia, attended by 25 trainees from all parts of the Commission area, closed on 21 February 1957, and P. A. Lusyne (Belgium), Associate Director of the Course, reported to FAO Headquarters prior to going on home leave. He will resume his duties in India afterwards.

Various technical assistance experts have ended their assignments.

Gonzalez Ferrer (Philippines) has completed the final report on his 2½-year assignment in Saudi Arabia as master fisherman, where his duties were to assist in the development of a fishing industry through the introduction of improved fishing methods, fishing craft, gear and equipment. When he started his assignment, there was not a single mechanized fishing boat, and Saudi Arabian fishermen used only simple hand lines and beach seines, and operated from sambouks and dug-out canoes. Now there is a fishing fleet of nine motor boats, ranging from two tons to 130 tons gross.

On completion of his two-year assignment in Turkey, Jon Einarsson (Iceland), master fisherman, stayed a few days in Rome on his return journey to his home country to write his final report. Mr. Einarsson's duties were to advise and assist the Government in mechanizing and improving fishing gear and methods, especially those used in catching such pelagic and migratory species of fish as anchovies, horse mackerel, mackerel, tuna and bonito. During his assignment he rigged for fishing a Pacific Coast type purse seine boat, trained a Turkish crew and demonstrated the use of this highly mechanized equipment and method.

Robert E. Lee (U.S.A.), has returned from his two-year assignment in Recife, Brazil, as master fisherman, where he has been advising and assisting the Government in the carrying out of experimental tuna fishing operations.

C. Olesen (Denmark), master fisherman, has prepared an interim report on his work in Chile, where he has completed 2½ years of his assignment, which is to last another year. During this time he had introduced improved long lines, gill nets and tuna trolling lures, as well as small power-driven gurdies for hauling the lines and gill nets.

Two technical assistance fishing fleet managers have taken up their 12-month assignments in India. Tsutomo Ishiro (Japan), is stationed in Calcutta, West Bengal, advising and assisting the Government on the management of its fleet of trawlers. This includes the direction and day-to-day operation of the fleet, explor-

ation for trawl grounds, the continuous maintenance of the boats, the landing and auctioning of fish, and office management. George McKenzie (U.K.) is advising and assisting the Central Government on the management of the Pilot Deep Sea Fishing Station in Bombay and in the direction and operation of the fishing fleet under the jurisdiction of the Station.

Dr. Hideaki Miyamoto (Japan), has taken up a 12-month assignment as fishing gear technologist in India, where his duties are to advise and assist the Government in planning and implementing a program of research on fishing gear, and the establishment of a gear research laboratory.

Other projects continue in Ceylon, Haiti, India, the Philippines, Sudan and Turkey.

Skapti Jonsson (Iceland), has taken up a 12-month assignment as master fisherman in Saurashtra, India, where he is giving assistance to the Government in implementing a program for the expansion and improvement of marine fish production, with particular reference to the use of small mechanized fishing craft.

Conversations have been held by Dr. W. F. Hampton, Chief of the Fish Processing Section, with Dr. David Hand, of UNICEF, regarding the present status of FAO's work on edible fish flour. In a large measure these have dealt with processing techniques and plans for additional collaborative work.

Preparations for an FAO/TA Latin American Fish Processing Training Center, to be held in Lima, Peru, from mid-October to mid-December 1957, are well under way. Dr. Hampton will act as Associate Director.

An interim report has been prepared by Dr. A.O. Torres Botelho (Portugal), who has completed an 18-month assignment in the Amazonas Region of Brazil as fishing processing technologist. He has been advising and assisting the Government on improved methods for the processing of fish by drying and salting, especially with regard to the improved utilization of pirarucú (*arapaima gigas*). He has also been assisting in the conduct of field extension work in the handling, processing and distribution of fish.

Other projects continue in Brazil and Thailand.

Economics and Statistics Branch

Statistics

Preparations for the publication of the *FAO Yearbook of Fishery Statistics 1955/56*, Vol. VI, are already well advanced. Draft tables containing data on fish production and fishing craft for individual countries have been prepared and distributed to all Member Governments and others able to provide information. They have been asked to check the figures and to bring them up-to-date through 1956. It is hoped to publish the volume in the last quarter of 1957.

Statistical Methods and Surveys

(*a*) *Handbook for Preliminary Fishery Surveys*

The draft of a handbook intended to help fisheries administrators to conduct simple preliminary surveys of fisheries industries, particularly in underdeveloped countries where skilled statisticians are scarce, is being prepared. The draft handbook will be made available to the Indo-Pacific Fisheries Council on the occasion of their Seventh Session at Bandung, Indonesia, in May 1957, and it is hoped that the procedures laid down in this draft can be tested in various countries over the next two or three years.

(*b*) *Sampling Methods*

K.V.R. Sastry (India), fishery statistician, who, in 1956, was working in Egypt, assisting the Government in improving the collection of fisheries statistics through the employment of sampling methods, is carrying out a short term assignment of four months in the Protectorate of Uganda, where he is similarly advising the local fisheries authorities on the use of sampling methods in the collection of production statistics, particularly on Lake Victoria and Lake Kyoga. At the end of this temporary assignment, Mr. Sastry is returning to Egypt.

Institutions and Services

Financial Assistance for the Acquisition or Improvement of Fishing Craft

An outline of the main purpose, provisions and operating procedures of credit schemes in Belgium, Canada, Denmark, France, Western Germany, India, Ireland, Japan, Malta, Norway, Spain, the Union of South Africa, and the United Kingdom, has been completed and distributed to the governments concerned, for comment. After amendment, this draft will then form the main part of a publication reviewing current credit arrangements and including a select bibliography of legislation in this field.

This work has been undertaken in response to many requests for information on this subject, and reflects the great importance attached to credit facilities both in the underdeveloped countries, where the fisherman is too poor to finance even the simplest modernization of his equipment and methods, and in the highly advanced fishing industries which must keep abreast of modern technological developments. In fact, a great deal of the progress achieved since the second World War has rested on the timely and adequate provision of credit. The schemes, however, reflect many differences — in their objectives; in the nature and

extent of financial assistance provided; in the methods used to channel credit and recover repayments. In the underdeveloped countries where credit facilities are a prerequisite of any significant change in the structure and economy of the industry, there is urgent need for information on the design and operation of successful credit schemes, while the more advanced fishing industries themselves have much to gain from an exchange of information on this subject.

Fish Marketing

F. H. Barlind (Sweden) continues his work in India, where he has organized a pilot marketing operation based on Mangalore. Trials have been made with the trucking of fresh fish in ice to various inland centers, and much valuable information has been obtained which will form the basis of a full-scale scheme to be operated during the next season.

John Fridthjof (Denmark), who has been engaged on a fish marketing assignment in Brazil, is being transferred to a similar post in Mexico, where he will be primarily concerned with consumer education.

D. Quiroga Rios (Spain), marketing specialist in Ecuador, is being transferred to an assignment with the Central American Integration Scheme.

Economic Surveys

Chile. J. P. d'Alarção, FAO fishery economist, who carried out a survey of the Argentine fishing industry in 1956, is organizing a team to make a comprehensive survey of the Chilean fishing industry.

Pakistan. Christian Eriksen (Denmark), who recently completed an assignment in Jordan as fish processing technologist, has now gone on a 12-month assignment to Pakistan. He is advising and assisting the Government in the carrying out of an economic reconnaissance survey to identify the factors which hamper fisheries development, and he will make recommendations regarding the measures to be taken to organize the fishing industry on a sounder basis. He is especially studying co-operative forms of organization and the problems of marketing.

Tunisia. F.L. Bourgois (France) has reached the final stage of his survey of the Tunisian fisheries, and an interim report containing detailed recommendations for a reorganization of the Tunisian fishery administration has been prepared and transmitted to the Government.

IPFC Current Affairs Bulletin

The first issue of the *Current Affairs Bulletin* of the Indo-Pacific Fisheries Council appeared in July 1951 in a mimeographed edition. This publication evolved from the decision of the IPFC at its second session that it should disseminate current information on activities in government fisheries departments and institutions in the Indo-Pacific Region, for the purpose of stimulating the interest of fisheries workers.

In the latest issue of the *Bulletin* (No. 18, March 1957), some 14 pages are devoted to the section " News from Member Governments ;" the material in this section is extracted from the reports received from the administrative correspondents of the IPFC Member Governments, giving information on the progress of fisheries activities. The feature article " The Role of the Fisherman in Society, " by W.H. Cummings, Regional Representative of the Director-General of FAO for Asia and the Far East, is the first of a new series to deal with important aspects of fisheries activities of particular interest to the Indo-Pacific Region.

The *Bulletin*, now printed, is distributed to fisheries workers and administrators in the Indo-Pacific Region. Copies are also available, on an exchange basis, to scientific institutions both within and outside the Region. Enquiries should be addressed to: The Secretary, Indo-Pacific Fisheries Council, Maliwan Mansion, Phra Atit Road, Bangkok, Thailand.

The Council has also recently issued a *Directory of Fisheries Institutions in Asia and the Far East* and *IPFC Occasional Paper* 57/1, " Documents published by, and otherwise contributed or presented to, IPFC through 1948-1956 " (mimeo).

New Publications

New Publication Series

The first of the series *Technical Papers of the Arctic Institute of North America* has appeared, with the publication of " The Plankton of the Beaufort and Chukchi Sea Areas of the Arctic and its Relation to Hydrography, " July 1956. The author is Martin W. Johnson, Professor of Marine Biology, Scripps Institution of Oceanography, University of California, La Jolla, Cal., U.S.A. The report is based on collections made by the U.S.S. *Burton Island* during the summers of 1950 and 1951.

This new series is planned by the Arctic Institute for the publication of papers which are too long or too technical for the average journal. It will thus fill a long felt need in the dissemination of data of scientific import in respect of the increasingly important field of northern research.

The Arctic Institute is the only North American organization entirely devoted to the advancement of fundamental research in the Far North. In addition to the *Technical Papers* series it publishes the quarterly journal *Arctic*, and a series of *Special Publications*

The Institute has three offices; 3485 University Street, Montreal, Que., Canada; 1530 P Street N.W., Washington 5, D.C., U.S.A.; and 2 East 63rd St., New York 21. *Technical Paper* No. 1 is available from the Canada Office, price: C$0.50.

New Russian Publication

ZENKEVICH. L.A. *Seas of the U.S.S.R., their Fauna and Flora* 1956 Gosudarstvennoe Uchebno, Pedagogicheskoe Izatelstvo Ministerstva Prosueshchenija RSFSR, Moscow, 1956. 424 pp., 305 figs., 114 tables. In Russian.

This well written textbook on marine ecology is a completely revised version of the author's earlier book *Fauna and Biological Productivity of the Sea.* Vol. II. *Seas of the USSR.*

The first part contains several chapters on general ecology, describing the distribution and abundance of plants and animals, and the factors affecting it. There is a summary on the biogeography of the seas. The second part covers the biology and ecology of the seas surrounding Russia (Barents, White and Siberian Seas, Black, Azov, Caspian and Aral Seas, and the North Western Pacific Ocean).

The numerous illustrations and tables make this a very interesting publication even to those who cannot read the language.

OEEC Training Course

Frozen Fish. Improved Quality and Packing as a Way to Improving Marketing and Consumption. OEEC Project No. 325, 1956 The European Productivity Agency of the Organisation for European Economic Co-operation, 2 rue André-Pascal, Paris 16. 158 pp., illus. In English.

Contains the proceedings of the OEEC Training Course held in Kiel, Western Germany, from 14 to 19 March 1955. The fish freezing industry in the participating countries is reviewed, and a full text of the seven technical papers delivered at the Course, together with summaries of discussions, are given.

Selected Publications Received

BLANKE W. *Die Seefischerei Nordwest-Europas - Struktur und Probleme* [The Sea Fisheries of Northwest Europe - Structure and Problems]. Verlag Krögers Buchdruckerei, Hamburg-Blankensee, Bahnhofstrasse 17. 1956. 611 pp., figs., tables. In German : chapter headings, annotations to tables, etc., in English also.

Handbuch der Werften 1956 [Shipyards' Handbook 1956]. Schiffahrts 1956 Verlag "Hansa," G. Schroedter & Co., Hamburg 11, Western Germany.

Vom Wasser. Ein Jahrbuch für Wasserchemie und Wasserreinigungstechnik [Water. A Yearbook of Water Chemistry and Water Purification]. Verlag Chemie, GmbH., Bergstrasse, Weinheim, Western Germany. Vol. 23 (1956), 1957. 292 pp., tables, illus. In German. Price : DM 27.40.

STABILIMENTO TIPOGRAFICO FAUSTO FAILLI - ROMA